MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2015/2016

PCM0035 – GENERAL CHEMISTRY

(All sections / Groups)

1 JUNE 2016
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 3 pages only excluding the cover page.
2. Attempt **ALL** questions. Distribution of the marks for each question is given.
3. Please write all your answers in the Answer booklet provided.

QUESTION 1 [20 MARKS]

(a) Supply the missing quantum number(s) or subshell names in **Table 1**.

n	l	m_l	name
(i)	(ii)	0	*3d*
4	3	-2	(iii)
5	(iv)	0	*5s*

Table 1 [2 marks]

(b) Vanadium is a chemical element with atomic number 23.
(i) Draw the orbital diagram for vanadium without using a noble gas core. [1.5 marks]
(ii) State the number of unpaired electron does vanadium has. [0.5 marks]

(c) Sodium is an element with an atomic number of 11.
(i) State the metallic behavior of sodium. [1 mark]
(ii) State the acid-base behavior of the sodium oxide. [1 mark]
(iii) Write a balanced chemical reaction equation for the reaction of sodium with oxygen gas. [2 marks]

(d) (i) Name the most reactive element in group 7A. [1 mark]
(ii) Give two ions that is isoelectronic with Na^+. [1 mark]

(e) (i) Write the Lewis dot symbols of the reactants and product in the reaction:
$Li + N_2 \longrightarrow Li_3N$ [1.5 marks]
(ii) Classify the following substances as ionic compounds or covalent compounds containing discrete molecules:
CH_4 SiF_4 $MgBr_2$ [1.5 marks]

(f) Name the shape (molecular geometry) and give the AB_mE_n classification for the following compounds:
(i) NF_3 [2 marks]
(ii) CO_3^{2-} [2 marks]

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(g) For the following compound in **Figure 1**:

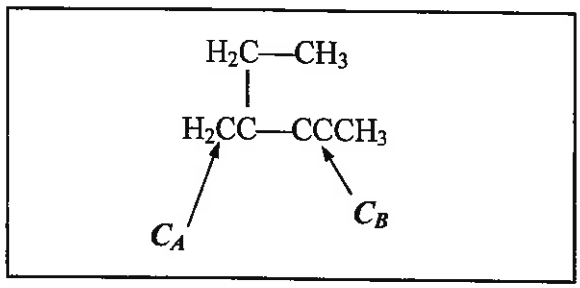

Figure 1

(i) Predict the correct hybridization for the carbon atom, C_A and C_B, indicated in the molecule. [2 marks]

(ii) Determine the number of sigma (σ) bonds and pi (π) bonds in the molecule. [1 mark]

QUESTION 2 [15 MARKS]

(a) List down four main classes of crystalline solids, and state the force holding the units together. [4 marks]

(b) The triple point for a pure substance X is at 115°C and 12 atm.

(i) Sketch and label fully the phase diagram of X. [2.5 marks]

(ii) State what happens when a sample of X is heated at room conditions. [1 mark]

(c) The rate equation for reaction: A + B ⟶ products is given by: Rate = $k[A][B]^2$

(i) What is the overall order of reaction? [1 mark]

(ii) What is the unit for the rate constant, k? [1 mark]

(d) At a certain concentration of A and B, the rate of reaction is x Ms^{-1}. Assuming all changes take place at constant temperature, what will the new rate be if

(i) the concentration of A is doubled. [1 mark]

(ii) the concentration of A is doubled and the concentration of B is halved. [1 mark]

(e) For the first-order reaction $2N_2O_5 \rightarrow 2N_2O_4 + O_2$ at a temperature, the half-life of the reactant N_2O_5 is 0.80 hour. What fraction of the initial concentration of N_2O_5 will remain after 1.5 hours? [2 marks]

(f) A reaction vessel contains NO_2, O_2 and NO at equilibrium at a certain temperature. The equilibrium concentration are found to be [NO] = 0.0542M; [O_2] = 0.127M, and [NO_2] = 15.5M. Calculate the equilibrium constant, K_c, for the synthesis of NO_2 if the reaction is represented as: $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$ [1.5 marks]

Continued...

QUESTION 3 [15 MARKS]

(a) (i) Calculate the concentration of H^+ ions in 0.8 *M* KOH solution. [1 mark]
(ii) Calculate the pH of a 0.5 *M* NaOH solution. [1 mark]

(b) Identify the conjugate base in each of the following reactions:
(i) $CH_3CH_2COO^- + HCN \rightleftharpoons CH_3CH_2COOH + CN^-$ [1 mark]
(ii) $H_2PO_4^- + OH^- \rightleftharpoons HPO_4^{2-} + H_2O$ [1 mark]

(c) Based on their molecular structure, select which acid is stronger and give reasons.
(i) HI or HCl [1.5 marks]
(ii) $HClO_3$ or $HClO_2$ [1.5 marks]

(d) **Figure 2** shows a diagram of a galvanic cell which has chromium (Cr) and silver (Ag) electrodes.

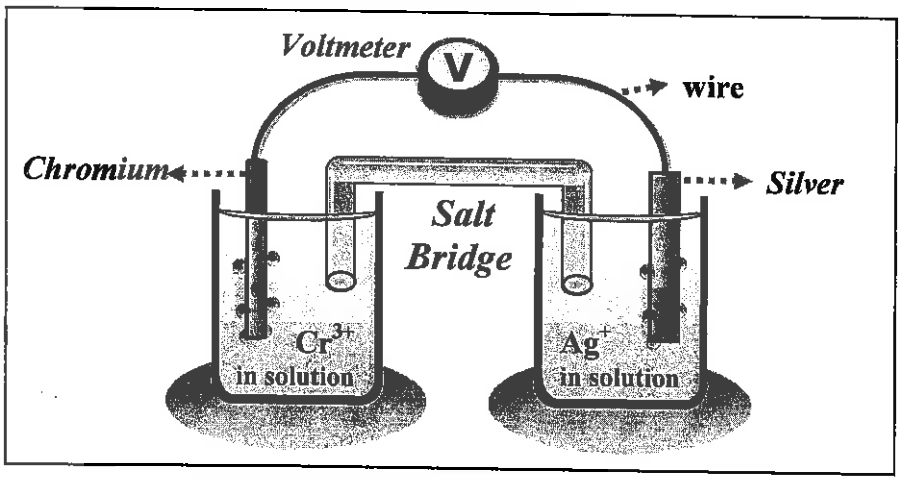

Figure 2

Based on this information, answer the following:

(i) Write the balanced equations for the reactions that take place at the anode and the cathode. [2 marks]
(ii) Identify the reducing agent and the oxidizing agent for the cell. [1 mark]

(e) A baby's spoon with an area of 6.25 cm^2 is plated with silver (Ag) from $AgNO_3$ using a current of 2.00 A for 2 hours and 25 minutes.
[*Atomic mass*: Ag = 107.87; *Faraday constant* = 96,485 C / mol e^-]
(i) How many grams of silver are plated (assume 100% efficiency)? [3 marks]
(ii) What is the thickness of the silver plate formed, if the density of silver is 10.5 g/cm^3? [2 marks]

End of Paper